

PENNSYLVANIA WATER & POWER COMPANY
and
SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

SUBSTITUTE PLANT
ESTIMATE OF CONSTRUCTION COST
AS OF DECEMBER 31, 1945

SUMMARY

Substitute Steam Plant

Acct No.	Item	Estimate
310	Land & Land Rights	
311	Structures & Improvements	\$1,666,117
312	Boiler Plant Equipment	1,893,286
314	Turbo-Generator Units	1,024,144
315	Accessory Electric Equipment	503,554
316	Misc. Power Plant Equipment	155,001
TOTAL STEAM PLANT		\$5,242,102

Substitute Hydro Plant

320	Land & Land Rights	
321	Structures & Improvements	\$5,501,738
322	Reservoirs, Dams, & Waterways	7,301,995
323	Hydraulic Turbines and Generators	6,571,954
324	Accessory Electric Equipment	2,216,053
325	Misc. Power Plant Equipment	370,824
326	Roads, Railroads & Bridges	
TOTAL HYDRO PLANT		\$21,962,564

Substitute Transmission Plant - P.W.& P. Co.

Acct No.	Item	Estimate
340	Land & Land Rights	6,214*
341	Clearing Land & Rights-of-Way	18,433
342	Structures & Improvements	7,204
343	Station Equipment	1,719,391
344	Towers & Fixtures	283,414
345	Poles & Fixtures	-
346	Overhead Conductors & Devices	92,462
349	Roads & Trails	-

TOTAL P. W. P. CO. TRANSMISSION	\$2,127,118
---------------------------------	-------------

TOTAL P. W. P. CO. SUBSTITUTE PLANT	\$29,331,784
-------------------------------------	--------------

Transmission S. T. Co. of Maryland

340	Land & Land Rights	\$ 47,255*
341	Clearing Land & Rights-of-Way	71,740
342	Structures & Improvements	383,384
343	Station Equipment	1,621,204
344	Towers & Fixtures	959,050
345	Poles & Fixtures	-
346	Overhead Conductors & Devices	336,776
349	Roads and Trails	-

TOTAL S. T. CO. OF MARYLAND SUBSTITUTE PLANT	\$3,419,409
--	-------------

TOTAL SUBSTITUTE PLANT	\$32,751,193
------------------------	--------------

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE HOLTWOOD STEAM PLANT

SUMMARY OF COST AS OF DECEMBER 31, 1945

Acct No.	Description	Total Direct Cost	Total Incl. Indirect Cost
311	Structures & Improvements	\$1,168,093	\$1,666,117
312	Boiler Plant Equipment	1,350,086	1,893,286
314	Turbo-Generator Units	730,308	1,024,144
315	Accessory Elec. Equipment	359,080	503,554
316	Misc. Power Plant Equipment	110,530	155,001
TOTAL DIRECT COST - 1945		\$3,738,097	
INDIRECT CONSTRUCTION COSTS		570,060	
Company Engineering, Super- vision and Expense		500,905	
Contingencies		280,357	
SUB-TOTAL		\$5,089,419	
Interest and Taxes During Construction		152,683	
TOTAL COST, HOLTWOOD SUBSTITUTE STEAM PLANT - 1945		\$5,242,102	\$5,242,102

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE HOLTWOOD HYDRO PLANT

SUMMARY OF COST AS OF DECEMBER 31, 1945

Acct No.	Description	Total Direct Cost	Total Incl. Indirect Cost
321	Structures & Improvements	\$3,761,101	\$5,501,738
322	Reservoirs, Dams & Waterways	4,991,793	7,301,995
323	Hydraulic Turbines & Generators	4,492,722	6,571,954
324	Accessory Electric Equipment	1,514,939	2,216,053
325	Misc. Power Plant Equipment	<u>253,503</u>	370,824
	TOTAL DIRECT COST - 1945	\$15,014,058	
	INDIRECT CONSTRUCTION COSTS	2,800,122	
	Company Engineering, Supervision and Expense	1,629,025	
	Contingencies	<u>1,276,195</u>	
	SUR-TOTAL	\$20,719,400	
	Interest & Taxes During Construction	<u>1,243,164</u>	
	TOTAL COST HOLTWOOD SUBSTITUTE HYDRO PLANT - 1945	\$21,962,564	\$21,962,564

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE TRANSMISSION PLANT

SUMMARY OF COST AS OF DECEMBER 31, 1945

Acct No.	Description	Total Direct Cost	Total Incl. Indirect Cost
341	Clearing Land & Rights-of-Way	\$13,669	\$18,433
342	Structures & Improvements	5,342	7,204
343	Station Equipment	1,274,994	1,719,391
344	Towers & Fixtures	210,163	283,414
346	Overhead Conductors & Devices	<u>68,564</u>	<u>92,462</u>
TOTAL DIRECT COST OF TRANSMISSION - 1945		1,572,732	
INDIRECT CONSTRUCTION COSTS		242,201	
Company Engineering, Supervision and Expense		139,973	
Contingencies		<u>102,227</u>	
SUB-TOTAL		<u>\$2,057,133</u>	
Interest & Taxes During Construction		<u>63,771</u>	
TOTAL COST PENNA. WATER & POWER CO. TRANSMISSION - 1945		\$2,120,904	\$2,120,904
*340	Land & Land Rights		<u>6,214</u>
TOTAL SUBSTITUTE PLANT ESTIMATE			\$ 2,127,118

* Penna. Water & Power Co. Estimate

SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

SUBSTITUTE TRANSMISSION PLANT

SUMMARY OF COST AS OF DECEMBER 31, 1945

Acct No.	Description	Total Direct Cost	Total Incl. Indirect Cost
341	Clearing Land & Rights-of-Way	53,198	71,740
342	Structures & Improvements	284,294	383,384
343	Station Equipment	1,202,185	1,621,204
344	Towers & Fixtures	711,173	959,050
346	Overhead Conductors & Devices	<u>247,508</u>	336,776
TOTAL DIRECT COST OF TRANSMISSION - 1945		2,498,358	
INDIRECT CONSTRUCTION COSTS		387,655	
Company Engineering Super- vision and Expense		222,354	
Contingencies		<u>162,393</u>	
SUB-TOTAL		3,270,760	
Interest & Taxes During Construction		<u>101,394</u>	
TOTAL COST S.T. CO. OF MD. TRANSMISSION - 1945		33,372,154	33,372,154
*340	Land & Land Rights		47,255
TOTAL SUBSTITUTE PLANT ESTIMATE			33,419,409

* Penna. Water & Power Co. Estimate

PENNSYLVANIA WATER AND POWER COMPANY

TREND DEC. 31, 1940
to
DEC. 31, 1945

HOLTWOOD SUBSTITUTE HYDRO PLANT

Acct. No.	1940 Direct Cost	Trend Factor	1945 Direct Cost
320			
321	\$ 2,906,570	1.294	3,761,101
322	3,831,000	1.303	4,991,793
323	4,110,450	1.093	4,492,722
324	1,332,400	1.137	1,514,939
325	229,000	1.107	253,503
326	-	-	-
TOTAL	*12,409,420		\$15,014,058

PENNSYLVANIA WATER & POWER COMPANY

and

SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

Trend Dec. 31, 1940
to
Dec. 31, 1945

Substitute Transmission Plant

Penn. Water & Power Co.

Acct No.	1940 Direct Cost	Trend Factor	1945 Direct Cost
341	\$ 9,736	1.404	\$ 13,669
342	4,210	1.269	5,342
343	1,151,756	1.107	1,274,994
344	159,335	1.319	210,163
346	68,564	1.000	68,564
TOTAL	\$1,393,601		\$1,572,732

Susquehanna Trans. Co. of Maryland

341	37,890	1.404	\$ 53,198
342	224,030	1.269	284,294
343	1,032,075	1.111	1,202,185
344	540,405	1.316	711,173
346	247,508	1.000	247,508
TOTAL	\$2,431,908		\$2,498,358

PENNSYLVANIA WATER & POWER COMPANY
 SUBSTITUTE STEAM POWER PLANT
 SUMMARY OF DIRECT COSTS AS OF DECEMBER 31, 1945

Acct No.	Cost
3111 Site Improvement see Acct. 3711	
3112 Substructure	\$ 205,325
3113 Building Superstructure	915,624
3114 Structures Equipment	<u>67,144</u>
TOTAL ACCT. 311	\$1,188,093
3121 Boiler Plant Equipment	<u>874,164</u>
3122 Coal Preparation Plant	<u>369,516</u>
3124 Coal Unloading & Handling Equipment	<u>106,406</u>
TOTAL ACCT. 312	\$1,350,086
3141 Main Turbo-Generator Unit	578,718
3142 Auxiliary Equipment	<u>151,590</u>
TOTAL ACCT. 314	\$ 730,308
315 Accessory Electrical Equipment	359,080
3161 Auxiliary Power Plant Equipment	70,530
3163 General Outside Mechanical Equipment	<u>40,000</u>
TOTAL ACCT. 316	\$ 110,530
TOTAL DIRECT LABOR & MATERIAL COST	\$3,738,097

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE HOLTWOOD HYDRO PLANT

SUMMARY OF DIRECT COSTS AS OF DECEMBER 31, 1940

Acct. No.	Item	Direct Cost
3211	Site Improvement	\$ ---
12	Powerhouse Substructure	1,369,100
13	Powerhouse Superstructure	750,700
14	Structures Equipment	261,700
15	Cable Tunnel	1,270
16	Operators' Village	---
17	Intake Equipment	446,000
18	Tailrace Equipment	45,000
19	Filter Plant	<u>32,800</u>
TOTAL ACCT. 321.		\$2,906,570
21	Dam Investigation	60,000
22	Dam	2,003,000
23	Forebay	239,000
24	Tailrace	817,000
26	Cofferdams	712,000
27	Reservoir	---
TOTAL ACCT. 322		\$3,831,000
31	Turbine Tests	---
32	Turbines - main units	1,800,000
33	Turbines - service units	45,000
34	Generators - main units	1,722,000
35	Generators - service units	31,400
36	Frequency Converter	487,050
37	Auxiliary Equipment	<u>25,000</u>
TOTAL ACCT. 323		\$4,110,450
41	Main Switching, cont. & prot. eq.	1,033,010
42	Aux. Switching, cont. & prot. eq.	112,000
43	Auxiliary protecting eq.	168,540
44	Excitation System	<u>18,850</u>
TOTAL ACCT. 324		\$1,332,400
51	Auxiliary Power Plant Equip.	<u>229,000</u>
TOTAL		\$12,409,420

PENNSYLVANIA WATER & POWER COMPANY
and
SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

Substitute Transmission Plant

Summary of Direct Cost as of Dec. 31, 1940

Pennsylvania Water & Power Company

Acct. No.	Description	Estimate
340	Land & Land Rights	---
341	Clearing Land & Rights-of-Way	\$ 9,736
342	Structures & Improvements	4,210
343	Station Equipment	1,151,756
344	Towers & Fixtures	159,335
345	Poles & Fixtures	---
346	Overhead Conductors & Devices	68,564
349	Roads & Trails	---
TOTAL PENN. WATER & POWER CO.		\$1,393,601

Susquehanna Transmission Co. of Maryland

Acct. No.	Description	Estimate
340	Land & Land Rights	---
341	Clearing Land & Rights-of-Way	237,890
342	Structures & Improvements	224,030
343	Station Equipment	1,082,075
344	Towers & Fixtures	540,405
345	Poles & Fixtures	---
346	Overhead Conductors & Devices	247,508
349	Roads & Trails	---
TOTAL SUSQUEHANNA TRANSMISSION CO. OF MARYLAND		\$2,131,908

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE HOLTWOOD HYDRO PLANT

INDIRECT CONSTRUCTION CGSTS AND COMPANY EXPENSE

Indirect Construction Costs

Constructor's Expense	2.30%
Constructor's Fee	3.50%
Insurance (Other Than Employee)	0.40%
Construction Equipment	4.40%
Temporary Construction & Service Facilities	7.80%
Camp, Commissary & Hospital	<u>0.25%</u>
Total Indirect Construction Costs	18.65%

Company Engineering Supervision & Expense

Legal Expense	0.50%
---------------	-------

Engineering & Supervision of Construction

Administration	0.50%
Field Engineering	2.50%
Office Engineering	5.00%
Accounting & Purchasing	0.25%
Office Supplies & Expenses	1.40%
Consulting Engr's Fees & Expenses	<u>0.50%</u>

Total Engineering & Supervision	10.15%
---------------------------------	--------

Preliminary Operating Expenses	<u>0.20%</u>
--------------------------------	--------------

Total Engineering Supervision & Expense	10.85%
---	--------

Contingencies	<u>8.50%</u>
---------------	--------------

Sub-Total	38.00%
-----------	--------

Interest & Taxes

Interest During Construction	5.88%
Taxes During Construction	<u>0.12%</u>
Total Interest & Taxes	6.00%

PENNSYLVANIA WATER & POWER COMPANY

SUBSTITUTE HOLTWOOD STEAM PLANT

INDIRECT CONSTRUCTION COSTS AND COMPANY EXPENSE

Indirect Construction Costs

Constructor's Expenses	2.30%
Constructors' Fee	3.50%
Insurance (Other Than Employee)	0.10%
Construction Equipment	3.70%
Temporary Construction & Service Facilities	5.40%
Camp, Commissary & Hospital	0.25%

Total Indirect Construction Costs 15.25%

Company Engineering Supervision & Expense

Legal Expense	0.50%
---------------	-------

Engineering & Supervision of Construction

Administration	0.50%
Field Engineering	2.50%
Office Engineering	7.00%
Accounting & Purchasing	0.75%
Office Supplies & Expenses	1.25%
Consulting Engrs. Fees & Expenses	0.50%

Total Engineering & Supervision 12.50%

Preliminary Operating Expenses 0.40%

Total Engineering Supervision & Expense 13.40%

Contingencies 7.50%

Sub-Total 36.15%

Interest & Taxes

Interest During Construction	2.90%
Taxes During Construction	.10%
Total Interest & Taxes	3.00%

PENNSYLVANIA WATER & POWER COMPANY
and
SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

Substitute Transmission Plant

INDIRECT CONSTRUCTION COSTS AND COMPANY EXPENSE

Other Direct Costs

Overtime Pay	3.428%
Labor Overheads	6.15%
Combined - Other Direct Costs	9.8%

Indirect Construction Costs

Constructor's Expense	2.7%
Constructor's Fee	4.3%
Insurance (Other Than Employee)	0.2%
Construction Equipment	1.5%
Temporary Facilities	4.7%
Camp Expense	2.0%

Total Indirect Construction Cost	15.4%
----------------------------------	-------

Company Engineering, Supervision & Expense

Legal Expense	0.2%
---------------	------

Engineering & Supervision of Construction

Administration	0.5%
Field Engineering	2.7%
Office Engineering	3.5%
Accounting & Purchasing	0.75%
Office Supplies & Expenses	1.25%

Total Engineering & Supervision	8.7%
---------------------------------	------

Total Company Engr., Supervision & Expense	8.9%
--	------

Contingencies	6.5%
---------------	------

Sub-Total	30.8%
-----------	-------

Interest & Taxes

Interest During Construction	3.0%
Taxes During Construction	0.1%
Total Interest & Taxes	3.1%

Note: *Other Direct Costs are applied to all Transmission Accounts, except Acct. 342. In Acct. 342, these items are included in the Unit Costs, as is the case with the substitute Steam and Hydro Plants. The percentage shown is applied to Direct Labor Cost Only.

PENNSYLVANIA WATER & POWER COMPANY
and
SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

Trend Factors
Dec. 31, 1940
to
Dec. 31, 1945

Substitute Transmission Plant

Pennsylvania Water & Power Company

Acct. No.	Labor Factor	% Labor	Material Factor	Material	Combined Trend Factor
<u>Steam Plant</u>					
311	1.390	50.64	1.200	49.36	1.296
312	1.39	16.19	1.057	83.81	1.111
314	1.39	30.00	1.274	70.00	1.310
315	Not used				(Turbine Foundation Only)
316	Not used				
<u>Hydro Plant</u>					
321	1.390	44.60	1.216	55.40	1.294
322	1.390	50.25	1.216	49.75	1.303
323	1.390	44.97	1.077	95.03	1.093
324	1.390	24.80	1.053	75.20	1.137
325	1.390	19.65	1.038	80.35	1.107
326	1.390	53.30	1.120	46.70	1.264

PENNSYLVANIA WATER & POWER COMPANY
and
SUSQUEHANNA TRANSMISSION CO. OF MARYLAND

TREND FACTORS DECEMBER 31, 1940 - DECEMBER 31, 1945

SUBSTITUTE PLANT

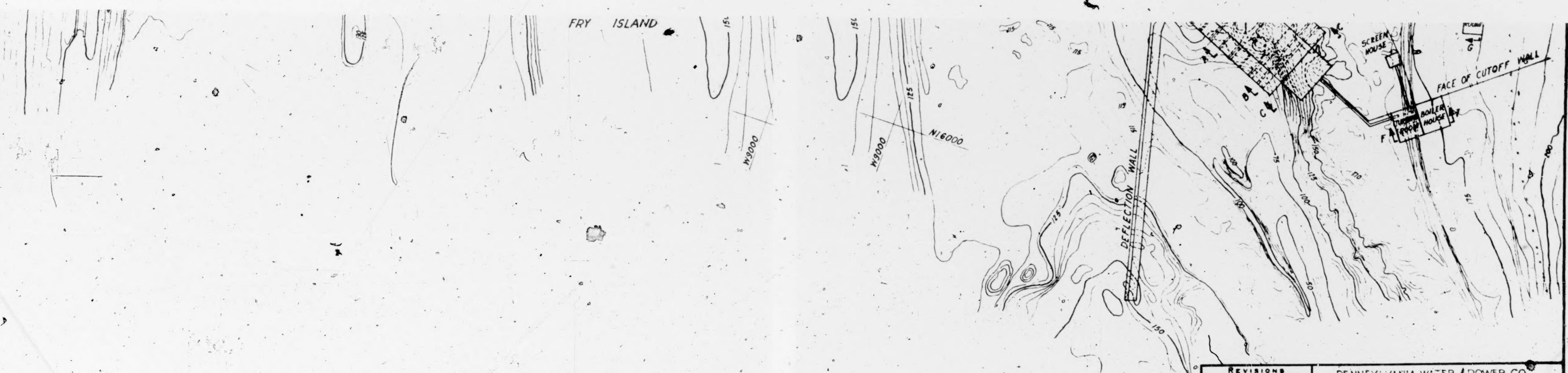
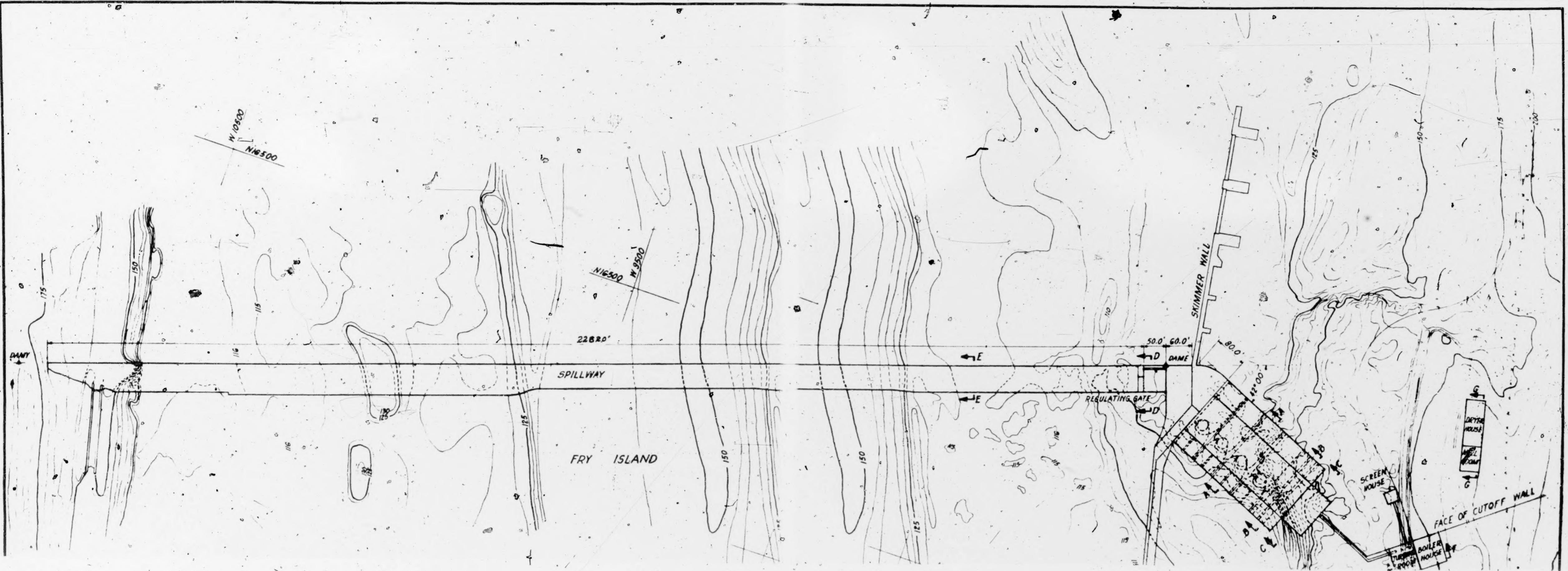
Acct No.	Labor Factor	% Labor	Material Factor	% Material	Combined Trend Factor
-------------	-----------------	------------	--------------------	---------------	--------------------------

Pennsylvania Water & Power Company Transmission Plant

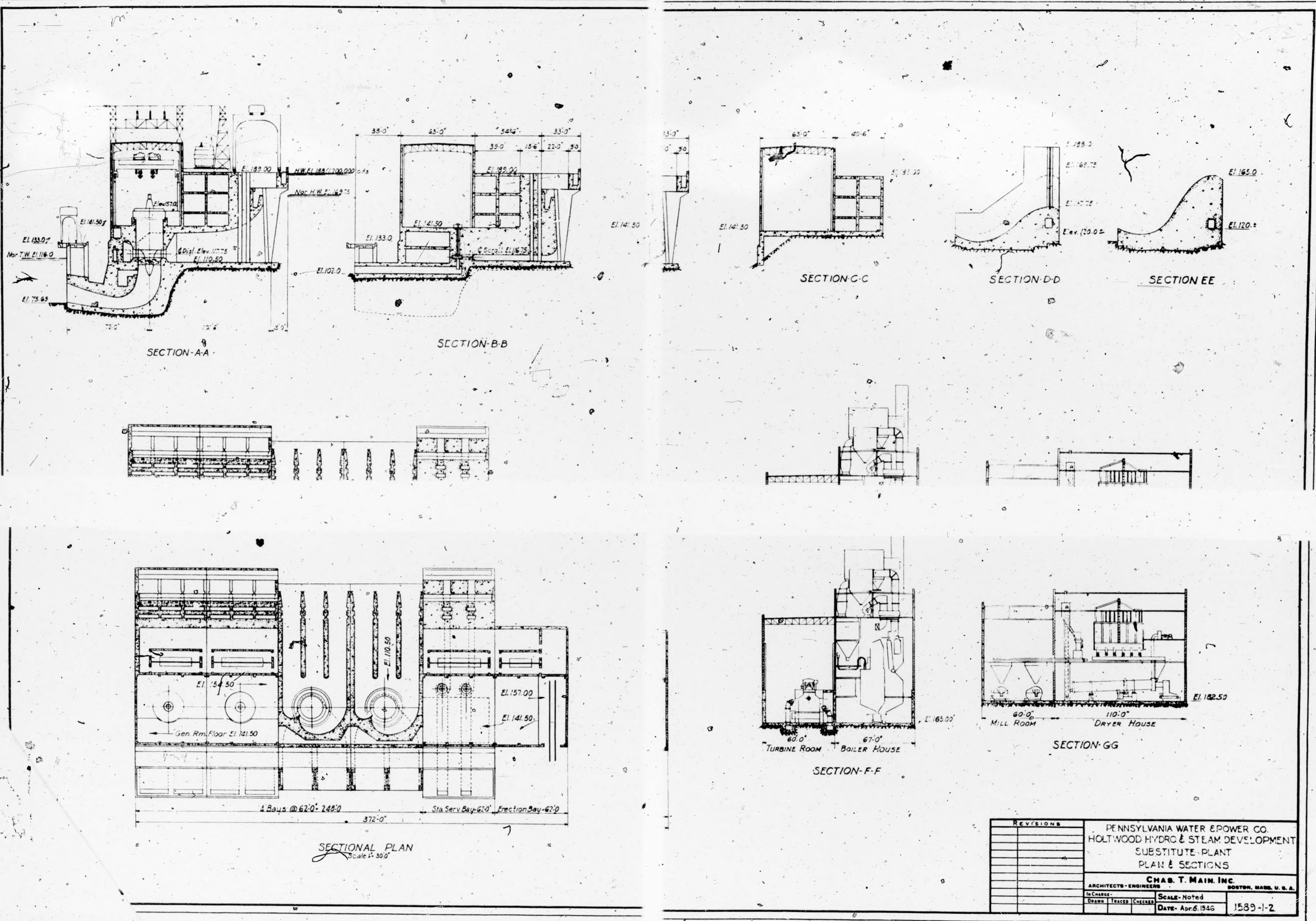
340	1.404	98.50	1.404	1.50	1.404
342	1.349	39.93	1.216	60.07	1.269
343	1.390	17.94	1.045	82.06	1.107
344	1.328	29.37	1.315	70.63	1.319
346	1.326	10.40	0.969	89.60	1.000
349	1.404	45.74	1.337	54.26	1.368

Susquehanna Trans. Co. of Maryland Transmission Plant

341	1.404	98.50	1.404	1.50	1.404
342	1.349	39.93	1.216	60.07	1.269
343	1.342	23.43	1.038	76.57	1.111
344	1.328	25.15	1.312	74.85	1.316
346	1.326	10.40	0.969	89.60	1.000
349	1.404	55.58	1.130	44.42	1.282



REVISIONS		<p>PENNSYLVANIA WATER & POWER CO. HOLTWOOD HYDRO & STEAM DEVELOPMENT SUBSTITUTE PLANT GENERAL PLAN</p>		
		<p>CHAS. T. MAIN, INC. ARCHITECTS - ENGINEERS CANTON, MASS. U. S. A.</p>		
In Charge:		SCALE - 1" = 100'		1589-1-1
DRAWN - PLACED - CHECKED		DATE - Apr. 11 1946		
MMW	-	-		



235'-0"

C

Battery Room

13.8 Kv. Buses

13.8 Kv. Buses

THIRD FLOOR PLAN

Control Room

Oil Circuit Breakers

Oil Circuit Breakers

SECOND FLOOR PLAN

Service Room

Potential Transformers

Potential Transformers

FIRST FLOOR PLAN

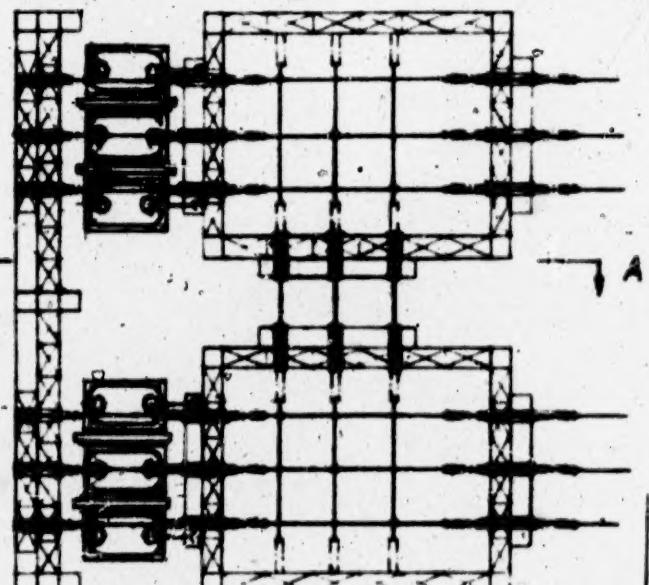
C

B

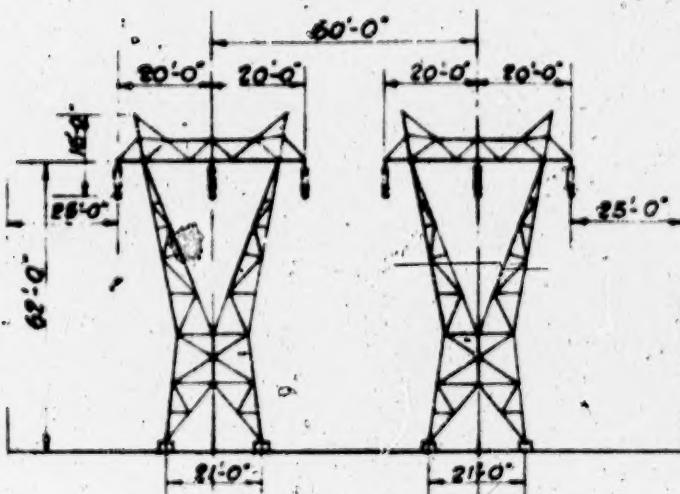
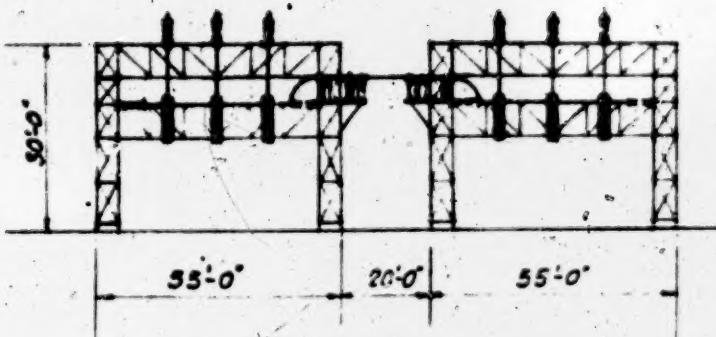
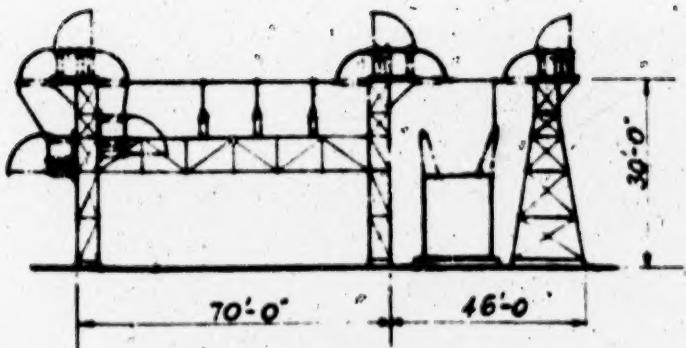
A

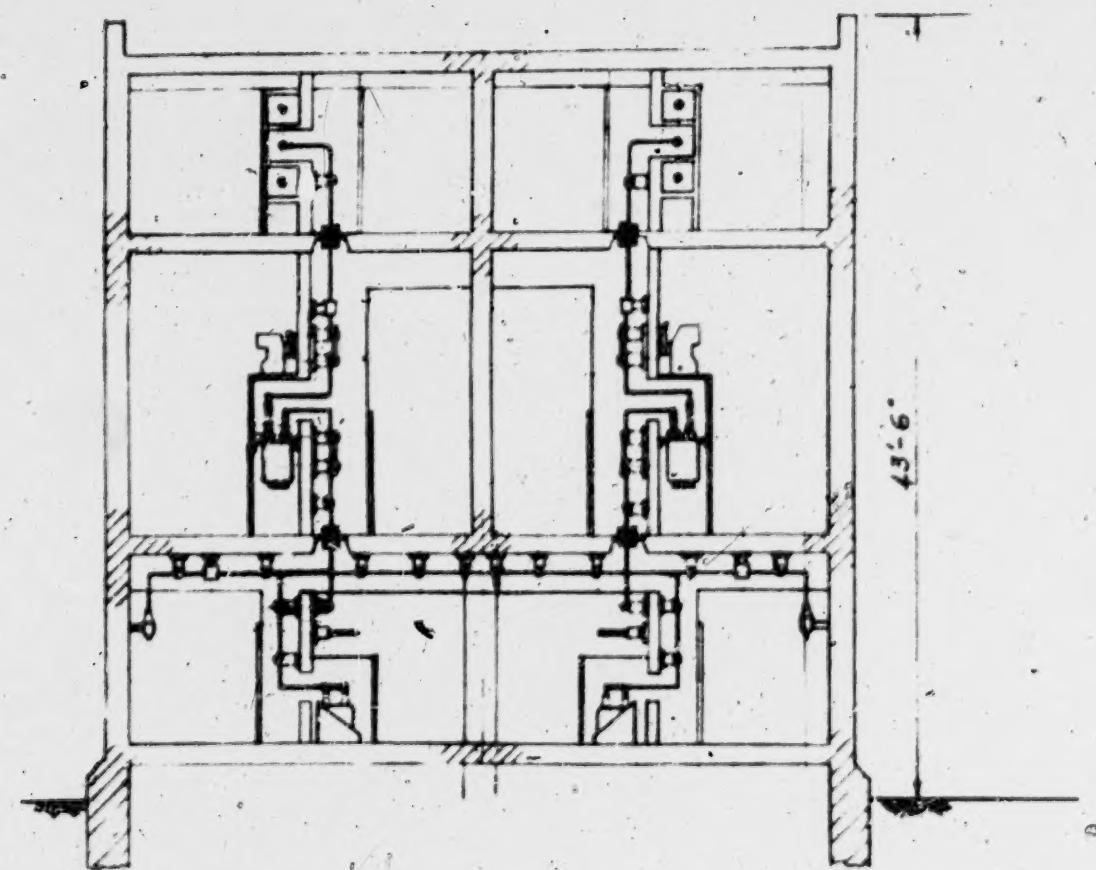
A

30'-0"



SWITCHYARD PLAN
HIGHLANDTOWN SUBSTATION
Scale 1'-0"





SECTION C-C
Scale 1/8" = 1'-0"

Page 3366
(Part 2)

NOTE -

High tension switching structure at Nottwood
similar to Highlandtown except mounted on power
house roof with transformers on intake deck.

SECTION C-C
Scale 1'-0"

NOTE -

High tension switching structure at Holtwood
similar to Highlandtown except mounted on power
house roof with transformers on intake deck.

Page 3366
(Part 3)

REVISIONS		PENNSYLVANIA WATER & POWER CO. SUSQUEHANNA TRANSMISSION CO. OF PA. HOLTWOOD-HIGHLANDTOWN TRANSMISSION SUBSTITUTE PLANT		
		CHAS. T. MAIN, INC. ARCHITECTS-ENGINEERS BOSTON, MASS. U.S.A.		
In Charge -		SCALE - AS NOTED		1589-1-3
Drawn	Traced	Checked	Date - 4-3-46	
E.A.C. S				

Exhibit No. 33

3367

EXHIBIT No. 33.

[22285]

BEFORE THE FEDERAL POWER COMMISSION

In the Matter of

Pennsylvania Water & Power Company and
Susquehanna Transmission Company of Maryland

IT-5915

TESTIMONY AND EXHIBITS OF DR. H. B. DORAU
RELATING TO THE SUPPLY OF MONEY AND
THE VALUE OF THE DOLLAR

Washington, D. C.
May 1, 1946.

[22286]

PROPOSED TESTIMONY OF H. B. DORAU

1-Q. Have you prepared an exhibit setting forth the changes in the supply of money in the United States over the period of 1914-1946?

1-A. Yes, I prepared a tabulation and chart setting forth Deposits, Investments and Loans of All Banks, as well as Currency in Circulation and Gold Stocks in millions of dollars for the period 1914-1946.

2-Q. Will you briefly explain the meaning and significance of this exhibit?

2-A. The chart in this exhibit graphically sets forth the rise in total bank deposits, gold stocks and currency in circulation, 1914-1945 and the rise of loans from 1914 to 1929 and the subsequent decline of loans.

It can be readily and quickly seen that total deposits have gone through two periods of substantial increase since 1933. The first rise took place from 1933 to 1943, during which period total deposits rose from \$36,919 million to \$71,027 million. The second and even more rapid rise brought the total of the June 30, 1942 of \$71,027 million to \$137,688 million as of June 30, 1945.

3-Q. What is the meaning and significance of total deposits in dollars?

3-A. Total deposits in dollars measure the quantity of dollar money which the banks owe the depositors and which the depositors can withdraw from the banks and spend as they may choose, time deposits with notice, other deposits on demand. Total deposits measure the potential expressible money spending power of depositors. Deposit dollars are money and thus a major part of the money supply of the country. The increase in [22287] (page 2) deposits therefore measures, to a large extent, the increase in the supply of money in the United States.

4-Q. Are there other components of the money supply?

4-A. Yes, currency in circulation.

5-Q. Will you explain your exhibit in further detail?

5-A. With respect to currency in circulation, reference to the chart indicates a gradual increase until 1939 when a rapid rise began. From a level of \$6,461 million as of June 30, 1938 the currency in circulation rose to \$9,612 million in 1941, to \$17,421 million in 1943 and to \$26,746 million in 1945.

As of June 30, 1945 currency in circulation was more than eight times the amount of June 30, 1914, and more than four times the quantity as of June 30, 1938.

Gold stocks, because they are at least in theory the basis of our monetary standard of value, are also important. The gold stock of the country has increased from \$1,699 million as of June 30, 1915 to \$20,213 million as of 1945. The rapid increase in gold stock took place after 1933, since which date the rise has been five-fold.

In 1933 the total of deposit money and currency in circulation was \$42,353 million, in 1945 the total of deposit money and currency was \$164,667 million, or close to a four-fold increase.

The difference between total deposits and loans is also important. Loans represent the extent to which people are in debt to the banks as distinguished from deposits which reflect the extent to which banks are in debt to their depositors.

[22288] (page 3)

As of June 30, 1919, following the last previous war, the excess of deposits over loans may be seen by reference to the tabulation which is a part of this exhibit, to have been only \$7,322 million (\$32,012 million less \$24,690 million). As of June

Exhibit No. 33

30, 1945 the excess of deposits over loans was \$109,709 million, or fifteen (15) times the excess of deposits over loans in 1919.

6-Q. What is the economic significance of this substantial increase in the quantity of money for the determination of a fair return in utility regulation?

6-A. The money revolution in the United States since 1933 constitutes the largest monetary inflation in the history of the country. The increase in the number of dollars of money in the country since 1933, and even more strikingly since 1941, is without parallel and unprecedented in this country.

The dollar is the economic measure of investment and return, of sacrifice and income. The quantity of dollars is therefore one of the important factors determining the size of the dollar as a unit for the measurement of economic sacrifice and return.

The yardstick as a linear measure does not change in linear significance when the number of yardsticks is increased, but the size of the dollar as a standard of measurement tends to decrease with an increase in the effective quantity of spendable dollars.

A change in the magnitude of any unit of measurement and enumeration destroys its validity as a standard of measurement and [22289] (page 4) comparison.

Merely calling the changed unit of measurement by the same name does not make it the same. The summation of such changed units of measurement, simply because they continue to have the same label, is as invalid as adding pears, peaches, peas and persimmons. The accounting summation of unlike dollars does not measure the investment sacrifice.

If the mile as a unit of linear measurement should have changed in magnitude as the dollar has changed as a measure of sacrifice and gain, no sen-

sible person would draw any conclusions from a comparison of ton-miles of railway service in 1907, 1917 and 1935. Before any informed person would believe that the ton-miles in 1917 exceeded the ton-miles in 1935, he would demand that such calculations be translated into an equated or equivalent number of ton-miles on the basis of the relative magnitude of the different length of the miles used.

Progress in every field of human endeavor has depended on the establishment of standard and comparable units of measurement. When the horsepower was the power of a horse instead of the energy equivalent of 550 foot-pounds per second, the enumeration of horsepowers was of limited accuracy and meaning.

When the foot was literally a "foot-length" instead of, as now 12 inches, linear measurement and comparison were uncertain and unreliable. It would be no more inappropriate to add nautical miles and land miles than to add 1907 dollars and 1917 dollars, but no respectable geographer would do so.

If the mile as well as the dollar had been redefined at 59 percent of its former magnitude in 1934, geographers and engineers would not make comparisons and enumerations without equating and adjusting for [22290] (Page 5) the differences in the actual comparative magnitude of the standard of measurement.

7-Q. Can the differences in the dollar as a unit of measurement of economic cost and income be equated so as to afford a reasonably comparable standard for the measurement of investment and return in utility regulation?

7-A. Yes, the variability of the dollar as a unit of economic measurement can be measured with reasonable accuracy so as to afford the basis for equating one size dollar with another. The size of the dollar is

measured by the goods and services which it can buy. Money is but the medium of exchange and the dollar is the unit of measurement, but the dollar varies in its purchasing power, its exchangeability for goods and services, and thus in its size.

This variability of the dollar can be equated so that the dollars of different size can be *legitimately* added and expressed as the equivalent of a fixed and certain sum of any other size of dollar, just as the sum of nautical and land miles can be equated and expressed as either so many nautical miles or the equated number of land miles.

8-Q. Have you prepared an exhibit which sets forth the change in the yearly average size of the dollar over the period 1902-1945?

8-A. Yes, I have prepared a tabulation which sets forth the purchasing power change in the size of the dollar by years from 1902-1945 and a seven-year moving average from 1905.

Column 1 identifies the years from 1902-1945.

[22291] (page 6)

Column 2 records the wholesale price index as reported by the United States Department of Labor, Bureau of Labor Statistics, with the average for 1926 equal to an index of 100.

Column 3 translates the index of wholesale prices into the purchasing power of the dollar which is determined by calculating the reciprocal of the annual averages in Column 2, i. e., by dividing the index of wholesale prices into 100.

Column 4 records the total of the seven years of Column 3, i. e., the total of the years 1902-1908 for 1905, and for each succeeding seven-year group in the same way down to 1943, for which a five-year total is ascertained, and for 1944 for which year a three-year

total is determined, and for 1945, for which a one-year total is taken.

Column 5 records the calculated seven-year moving average of Column 3 plotted on the fourth year center, except that for the year 1943 a five-year average is calculated and recorded, for 1944 a three-year average, and for 1945 a one-year average.

Column 6 records the translation of the seven-year moving average index of the purchasing power of the dollar to an index with 1945 as 100 for ease of comparison.

9-Q. Does the United States Department of Commerce calculate and report the changing purchasing power of the dollar?

9-A. Yes, in the Survey of Current Business.

10-Q. Does it use the same index of wholesale prices which you have used?

10-A. Yes, the Department of Commerce calculates the purchasing power of [22292] (page 7) the dollar as the reciprocal of the index of wholesale prices.

11-Q. Why did you use a seven-year moving average, except as noted?

11-A. The period of time from 1902-1945 is long enough to accommodate a seven-year average and a seven-year average satisfactorily eliminates minor and short-term changes which are more in the nature of fluctuations.

12-Q. Why did you use a five and three-year average for 1943 and 1944 and the one-year average for 1945?

12-A. In order to taper off the seven-year average and bring it down to the current time and date of 1945. This is satisfactory and justified since the trend during these years was in the same direction and accelerating. Moreover, since the continuing trend in 1945 and 1946 is strongly in the direction of higher prices and a cheaper dollar, the result is conservative.

13-Q. What, in brief, does the index developed, in Column 6 of this exhibit, disclose as to the changing economic size of the dollar?

13-A. Treating the 1945 dollar as 100, or par, the dollar of 1905 was 73.2 percent larger. The average size of the dollar was larger than in 1945 in every year down to 1918. From 1918 to 1923 it was slightly and temporarily below 100, but since 1922 the purchasing power of the dollar has been above 1945 by as much as 42.3 percent in 1934 and on the average for the period 23 percent above 1945.

From 1905 to 1918 the purchasing power of the dollar was on the [22293] (page 8) average 50 percent above 1945.

From 1918 to 1923 it was on the average 5 percent below 1945.

For the entire period 1905-1945 the average purchasing power of the dollar on the basis calculated in Column 6, was 28 percent above 1945.

14-Q. Do you find in these evidences of the changing magnitude of the dollar any basis for the conclusion that the changes in the economic size of the dollar can be disregarded because the fluctuations are compensatory?

14-A. No. There is no evidence to support such an assertion in this exhibit or anywhere. I have just pointed out that the average of the entire period is 28 percent above 1945 and that in every year except five during a 44-year period the purchasing power of the dollar was above 1945. My use of a seven-year moving average is proper treatment of mere fluctuations in the short term and even if in the long term there were compensations, changing investments and investors would make the *assumption* of a constant dollar inequitable.

The long term trend, however, is not and has not been compensatory. The price level has been ris-

ing since 1897 and the dollar reciprocally declining in size. The trend continues. Forces and factors justifying the expectation that the dollar will continue to shrink in size are clearly in evidence. Among the more obvious of these factors are the unparalleled quantity of money, the rate of spending, the size of the public debt, and the new and high levels of wages.

15-Q. Has the dollar been legally re-defined during the period covered by your exhibit?

[22294] (page 9)

15-A. Yes, before January 31, 1934 the "dollar" was the name for 23.22 grains of fine gold; after January 31, 1934 the name "dollar" was used to mean 13.714 grains of fine gold. The legal post-1934 dollar is only 59 percent the size of the pre-1934 dollar. The dollar has been changed legally as well as economically, but the name remains the same, and so book-keepers add and subtract these different dollars without distinction!

16-Q. Has the distinction between the calculation of economic sacrifice and return in nominal and actually comparable dollars been recognized in other economic areas?

16-A. Yes. In the field of wage determination and administration the distinction between nominal dollar wages and real wages is fully recognized and well understood by wage earners and others.

17-Q. What is the economic meaning of the term investment?

17-A. The investment process consists of converting liquid or alternatively applicable economic resources into indirect goods capable of income production. Investment involves the sacrifice of alternative goods and the alternative goods given up measure the investment.

An investment may be made through the medium of money (as is most common in our day) or by direct investment of labor, risk-taking and the cost of waiting or postponement of income to the future. The investment in any economic undertaking may and commonly does consist of both money investment and direct investment. In any case the investment is measured by the sacrifice made to produce a future [22295] (page 10) income, whether accounted for by bookkeeping or not, and whether in the form of money expenditures or direct sacrifices made without the intervention of the medium of exchange money.

18-Q. Assuming the *entire* investment of two enterprises to be reflected by the same number of accounted for dollars, does it follow that the investment in the two enterprises is the same?

18-A. No, it is the same only in the number of nominal dollars. If those dollars are not of equal size and economic significance, the investment sacrifice is not the same. If one was in 1918 dollars and the other in 1905 dollars, the actual investment would (as measured by the index of dollar purchasing power in Column 6 of my exhibit) be 73 percent greater in 1905 dollars than the investment of the same number of accounted for 1918 dollars.

A larger number of small dollars may actually constitute a smaller investment than a smaller number of larger dollars.

19-Q. What is the economic meaning of the investment standard for utility rate-making?

19-A. The investment standard proposes that the investor receive a fair return on the dollars (or dollar equivalent) which he gave up and invested, i. e., on the total sacrifice made. It is a sacrifice standard as distinguished from a value standard and cannot be fairly construed to mean the sacrifice of an equal number of other dollars since they would not measure the investment sacrifice made.

[22296] (page 11)

20-Q. Does the sum of the nominal dollars invested (in money and/or goods and services) measure the investment actually made, if made in dollars of different economic size and purchasing power?

20-A. Obviously not. An investment made by the sacrifice of dollars having a purchasing power of 100 would be equal to the investment of twice the same number of 50-cent dollars. It seems almost too simple to have to explain that an investment sacrifice of 1,000,000 hundred-cent dollars is the same as an investment of 2,000,000 fifty-cent dollars.

21-Q. Is it possible to express the nominal investment in an enterprise made in various kinds of dollars in terms of an equivalent number of dollars of equal size and equal investment significance?

21-A. Yes, very easily. The relative size and investment significance of the dollars sacrificed each year can be determined by reference to an index of purchasing power. By weighting the dollars invested each year by their purchasing power an average purchasing power dollar related to any desired base can be obtained and the investment in terms of any weight of dollar determined. In this way the constant dollar equivalent of the investment of heterogeneous dollars of different vintage and size can be determined.

22-Q. Have you applied this method to the dollars invested in electric plant in service of Pennsylvania Water & Power Company including Susquehanna Transmission Company to determine the investment sacrifice of 1945 dollars?

[22297] (page 12)

22-A. Yes, I requested that the Company provide me with a distribution of the \$36,414,232 of electric plant in service (before adjustments and construction work

in progress and property held for future use) by years according to year of origin of the dollars of electric plant in service December 31, 1945.

The Company provided the desired information and I have used the same in the first numerical column of a two-page tabulation and chart which I have prepared.

23-Q. Will you explain this tabulation and chart?

23-A. Column 1 of the tabulation identifies the years from 1905-1945. Column 2 records the dollars of investment in electric plant in service December 31, 1945 according to the year of origin of the investment.

Column 3 repeats the moving average purchasing power of the dollar as previously developed with 1945 as an index of 100.

Column 4 of this tabulation expresses the equivalent number of 1945 dollars which were invested in each year in electric plant and which remained in service on December 31, 1945.

The original investment in electric plant recorded opposite each year for the period 1905-1945 in Column 4 is determined by multiplying the annual investment of each year of various size dollars by the factor in Column 3 which measures the relationship of the purchasing power of that year's dollars to 1945 dollars. To illustrate, in 1905 2,135,006 dollars were invested which represented electric plant in service as of December 31, 1945. The dollar of 1905 had 1.732 times the purchasing power of the 1945 dollar. Multiplying 2,135,006 by 1.732 results in the number of equivalent 1945 dollars in the amount [22298] (page 13) of 3,697,830.

By the same method the equivalent number of 1945 dollars was determined for the investment of each year which remained in service as of December 31, 1945.

The number of 1945 dollars which represent the equivalent investment sacrifice of the dollars recorded in Column 2 is found by adding the figures in Column 4 to obtain a total.

It will be seen that the 50,091,106 1945 dollars are the equivalent investment sacrifice of the 36,414,232 nominal dollars of various vintage and diverse size.

The accompanying chart sets forth the method and result graphically.

The purchasing power of the dollar of each year (based on the seven-year moving average) is indicated by a bar in size relative to the purchasing power of the dollar of 1945 as 100 cents.

Examination of this chart indicates that the size of the dollar of 1905-1918 was consistently and substantially in excess of the economic size of the dollar of 1945; on the average it represented a 50 percent greater investment.

These were the years in which a substantial part of the investment remaining in service December 31, 1945 originated, as may be observed by reference to the first numerical line below the graphic section of the chart, and the years 1905, 1906, 1907 and 1910 in particular. Other years of large investment were 1923, 1924, and 1925 when the purchasing power of the dollar was not much above what it is in 1945. The large investments of the years 1931, 1934 and 1937 were, however, made in dollars of substantially larger purchasing power and investment sacrifice than 1945 dollars.

[22299] (page 14)

The dotted horizontal line affords a convenient reference for comparison of the investment sacrifice of each year with 1945. It will be readily seen that except for the years 1919, 1920, 1921 and 1922, in-